Robert L. Bates

Journal of Geological Education

Volume 8 - Number 1

Spring 1960

Published semiannually by

THE NATIONAL ASSOCIATION OF GEOLOGY TEACHERS

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The JOURNAL OF GEOLOGICAL EDUCATION is published by the National Association of Geology Teachers semiannually in the spring and fall, at the Heer Printing Company, Columbus, Ohio

Single issues: $1.25 for Vol. 2, No. 1 and later issues; $1.00 for Vol. 1, Nos. 1-6

Address all communications regarding subscriptions, orders for single issues and back issues, change of address, etc. to the national treasurer of NAGT:
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Princeton University, Princeton, New Jersey
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Journal of Geological Education

Volume 8 Spring 1960 Number 1

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 8, No. 1, Spring 1960, pp. 1-5.

AN ADVANCED PHYSICAL GEOLOGY COURSE FOR HIGH-SCHOOL SCIENCE TEACHERS

C. D. CAMPBELL

Washington State University

ABSTRACT. In this eight-week Summer Institute course, physical geology was presented as an evolution of ideas: newly published research was shown to be dependent upon progressively earlier discoveries. Historically important experiments were reproduced as feasible in the laboratory.

The writer wishes to compare notes with any other people who have taught a geology course to high school teachers of science—or, as one of them described himself, "a coach who can also teach science"—and reports herewith on his own philosophy, approach, and degree of success in a Summer Institute sponsored by the National Science Foundation in 1958 at the State College of Washington (now Washington State University).

Fifty science teachers were selected to come, with expenses paid by the N. S. F., for training in physical and biological sciences that would improve their teaching. These fifty were chosen, from some 1200 applicants, as teachers who were apparently serious of purpose and neither too recently out of college nor too near to retirement.

THE DILEMMA

The college transcripts of the fifty showed strong but uneven training in physics, chemistry, mathematics, and biological sciences, but little in geology; in fact, few had taken even an introductory geology course. Consequently, the problem of devising suitably advanced courses was difficult, as we could not simply provide advanced work in geology, either specialized or general, for lack of students having the usual prerequisites. On the other hand, the prospective students had more than enough prerequisites in physics, chemistry, mathematics, and biological sciences, to profit by courses presenting geology analytically, as an experimental science. But now the shoe was on the other foot, as the staff felt that they themselves did not have the prerequisites for teaching such courses, being primarily trained in field observation and deduction, not in experimental work.

THE COMPROMISE

With these limitations in mind, we decided on an entirely new approach, in the hope that it would put geology—and by implication the other sciences—in their proper perspective of growth and development from earlier ideas. To be realistic about presenting these courses, which would thus be almost courses in the history of geologic science, we should have had to point out that the growth of geologic ideas did not take place in a vacuum, but that they were favored or retarded by various social pressures of their time. But obviously such considerations would have overtaxed both students and instructors, and would have lost sight of the primary objective of introducing the science teachers to geology. Therefore we retreated again into the fiction that scientific ideas develop and are adopted independently of social environment, and gave our whole attention to the generally accepted facts about the growth of each geologic field. We arranged also to give prominence to the more interesting and important findings reported currently in the journals, since these would be of considerable interest to the students.

In addition, the staff decided that it would be better to have a wide coverage of the field than an intensive treatment of only two or three specialties such as petrogenesis, glacial geology, or invertebrate paleontology. Accordingly, two geology courses were included in the general curriculum called MATS (Master of Arts in the Teaching of Science, either physical or biological). These were entitled *The Face of the Earth* and *The History of the Earth.* They were to be usable as graduate credit only by people in the MATS program, and had as prerequisite only the introductory course. As a result, thirteen enrolled for the first offering of *The Face of the Earth.*

THE EXPERIMENT

It is not advisable to outline here the whole course of 29 lectures and 7 laboratory sessions, but to provide an illustrative sampling of them. Three examples should show the pattern of each lecture, presenting some recent idea in its true status as the inheritor of a long train of earlier ideas.

Form of Lectures. In each of the three examples below, the statements provided in advance to the class are quoted, and summaries of the actual lecture treatments follow these.

1. "June 17—*Size and Shape of the Earth.*

   The shape of the Earth is irregular, something like that of a battered orange. *References:* Heiskanen; Sarton *Introduction;* Wright; Jones; Bowie."

This was the first lecture of the summer, and it was selected as background for the first "laboratory experiment", described later, for the following Saturday, June 21. Heiskanen's phrase "battered orange" was first amplified; but the last half-hour of the lecture was spent in summarizing (or "skimming" may be more accurate) the history of ideas about the shape and size of the Earth, beginning with Pythagoras' initial concept of a spherical Earth, continuing briefly with Eratosthenes' measurement of its circumference, and mentioning the theological retrogression to

a flat Earth during the Middle Ages. Next were described the hypothesis (Cassini and Newton) and measurement (Bouguer and later others) of polar flattening; the concept of the geoid; and last the progress of intercontinental geodetic measurements.

2. "July 3—*Surface and Underground Water.*

Proportions of the various ions to each other, in springs, give a clue to the origin of the water.

References: White; Adams; Palissy; Boynton; Sarton *Introduction;* Mather; Kuenen."

D. E. White's conclusions in the G. S. A. Bulletin of December, 1957, were reviewed. Then we worked backward, trying to keep a connection with successively earlier major developments in the study of ground water: T. M. Reade's estimate in 1885 of the content of dissolved material in the Mississippi River; Lesley's correct explanation in 1869 of karst topography; and Gilmer's correct explanation in 1818 for Virginia Natural Bridge. At the end of the class period, with far too little time to spend on it, we reviewed the ancient debate on the origin of springs from rainfall *vs.* their passage underground direct from the ocean; how these ideas were tested in the Alps by President Vallisnieri of the University of Padua in 1715, and how the water budget of the Seine Valley was calculated in 1674 by Perrault, demonstrating that rainfall could and did account for the volume of springs.

3. "July 15 and 16—*Vanished Glaciers.*

It is sometimes possible to determine the thickness of a former ice sheet by testing the compressibility of the sediment that was under it.

References: Harrison; Charlesworth; Flint; Mather; Agar; Adams; Moore."

W. Harrison's article in the January 1958 *Journal of Geology* served here as a point of departure for tracing the development of ideas about the existence and activity of glaciers during the Pleistocene, expanding the summaries by Flint and Charlesworth. We even managed to work in some post-glacial climatic change, with evidences from tundra-forest sequence and pasture-desert sequence, emphasizing the resultant cultural changes.

Form of Laboratory Work. In keeping with the historical treatment of the lectures, the laboratory exercises attempted to duplicate some of the classical experiments by which geologic science has advanced. This turned out to be more easily said than done; and it will be seen from the three examples described below that some "hedging" was necessary.

1. First laboratory, June 21, 1958—*The Earth.* We repeated, with necessary variations, Eratosthenes' measurement of the circumference of the Earth. Instead of hunting for a vertical well at the south tip of Lower California, as Eratosthenes did at Syene, we used an atlas for the mileage from Pullman to the nearest Tropic; but we did get our zenith distance for the sun, not anachronistically with a clinometer or sextant, but from the length of shadow cast by a vertical object of known height. On the preceding day we had calculated Local Civil Noon

in terms of Pacific Standard Time, when we should make our measurement; and this operation familiarized the students with the Solar Ephemeris Tables. By and large, Eratosthenes did it better. For good measure, we determined where the North Magnetic Pole was, in the style of William Gilbert, by establishing our magnetic declination from the true-north that we had obtained during the Eratosthenes experiment, and with the help of a dip needle and a formula. This too had a rather qualified success, thanks to the existence of buried power lines and the ever-present basalt of the Palouse area. Nevertheless, the students believed that they could adapt the idea nicely to their high-school classes.

2. Second laboratory example, June 27, 1958—*Crystallography.* We checked up on the work of Stenonis and Romé de l'Isle, by verifying the Law of Constancy of Interfacial Angles, using both one-circle reflection and two-circle contact goniometers newly made for the purpose. We should have preferred to use whatever method Stenonis used in the 1660's for measuring his quartz crystals; but nothing in his own or later writings showed how this was done, unless his drawings are the result of tracing. In fact, Carangeot gets credit for the first (1780) contact type, and Wollaston (1809) for the first reflection type. During the course of measuring, recording, and comparing, the class was exposed to Haüy's Law of Rational Indices.

3. Third laboratory example, July 25, 1958—*Petrography.* The objective here was to point out the revolution effected in petrology by the invention of the polarizing microscope. To achieve this, several pairs of similar-appearing but actually different rocks were compared, first in hand specimen only and then in thin section. Such pairs included, for example, a silver-gray silicified argillite and a welded tuff of similar appearance; and a diorite and a graywacke of similar appearance. A minimum optical description of the chief minerals had to be supplied, and a short demonstration of the operations of the polarizing microscope provided; and the writer, who annually teaches a semester course in optical mineralogy, was unnerved to find that this much instruction appeared to suffice.

The writer made desperate mental efforts to justify and adapt to laboratory use Usiglio's examination of the composition of sea water, even commissioning his friends to collect ten gallons of Pacific Ocean water whenever they could; but as the experiment is mainly physical and analytical chemistry, and none too simple to perform, this idea for a laboratory was regretfully dropped. He was baffled also in attempting to repeat Cavendish's measurement of 1798, using Michell's apparatus, of the gravitational constant and thereby to determine the mass of the Earth; but this required too delicate and protected a balance. The complexity and cost of apparatus (not to mention the writer's inexperience) ruled out even thinking of crucible experiments bearing on petrogenesis, suggested in 1816 by Hausmann and developed by Vogt and the Bowen school.

Examinations. These were nothing unusual. There were four of them, each preceded by a sheet of sample questions handed out a week in advance.

Field Trips. Due to the tightness of the summer schedules, the only field trip we could work in was a half-day one in lieu of a laboratory. Near the end of the

summer, the Director of the Summer Institute, who has a considerable interest in geology, arranged a four-day loop trip primarily to tour the atomic reactors in the AEC reservation of southeastern Idaho. For this, the writer provided a generalized geologic log for the route, which led from Pullman through the Coeur d'Alene mining district, Idaho; Missoula, Montana; and south through Salmon and Challis to Arco, Idaho. The return route was west to Boise and north past the Payette Lakes to Pullman. The reports are that the conversations in the pool cars were a good deal more about geology than nuclear chemistry; hence, since less than half of the travelers were enrolled in the geology course, the course members must have made some converts.

CONCLUSIONS

By far the most interesting part of this course to the students appeared to be the reports of new research which served as opening remarks in each lecture. The historical developments seemed less interesting because of some combination of the instructor's inadequacy, the limitations of time, and the students' weakness in general historical background. Historical problems involving calculations were the ones that engaged the students most; for example, the calculation of the gravitational attraction exerted by a small Scottish hill upon Maskelyne's plumb-bob 1500 feet distant, as against that exerted by the Andes Mountains upon Bouguer's plumb-bob 50 miles distant.

The class was clearly more at home in the new research. For example, the erosive potential of cavitation in mountain streams fitted well into their understanding of erosion of dam aprons derived in a physics course, and they set about calculating implosion forces for bubbles of various sizes and depths of submergence. When appreciation was expressed by class members, it related to the new-research aspect of the course, not the historical portion.

RECOMMENDATIONS

The conclusion seems justified, now that this first experiment has been run, that the next offering for these science teachers should perhaps emphasize geological processes as expressions of physical and chemical laws. Whether the science teachers could adapt the contents of such a course to the uses of their own pupils is a problem. If this has been tried, the writer would like to know the results, for comparison with the results of this course.

Letters received from eleven of the thirteen teachers in the course indicate that most of them are making some use of both new and historical material, according to their judgment. Several of them are introducing geology, or increasing the geology, in their physical science courses, and a couple are essentially undertaking new geology courses. In short, the results are phenomenal, and the writer wishes the same results for similar summer courses elsewhere in 1960 and the following years.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 8, No. 1, Spring 1960, pp. 6-8.

A SUGGESTED PROGRAM TO MEET THE CRITICAL NEED FOR TEACHERS

RALPH YALKOVSKY
Montana State University

ABSTRACT. The geology department at Montana State University has under consideration a program for teacher training. If adopted, it will permit the candidate to receive the general secondary teaching credential as well as the Master's degree in geological education, thus enabling him to teach in the high school, the junior college, or the small liberal-arts college. The ultimate fate of this program and its general nature may depend to some degree on the opinion of members of the profession as to its desirability.

The geology department at Montana State University has under consideration a program for teacher training designed to help alleviate the critical demand for teachers which is expected during the next decade. The program is aimed toward the student who has already earned the baccalaureate degree in geology. It will lead to the Master's degree in geological education, and to a general secondary teaching credential, thus preparing the recipient to teach in the high school, the junior college, or the small liberal-arts college.

Since overemphasis on strictly geological subjects at the graduate level may impair the candidate's opportunities for employment in teaching, all required graduate courses will be in the field of geological education. Additional courses may be taken from the general graduate geology curriculum so as to total about one-third of the required course work for the Master's degree. The remainder of the candidate's course work will be in cognate fields at the upper division level.

Because we believe that thorough knowledge of the subject matter is essential for proper instruction in science, and because many of the problems of geological instruction are special ones not encountered in other fields, the courses in geological education will be taught by the staff of the geology department.

In conjunction with the school of education, a series of general education courses will be offered to ensure the candidate a general secondary teaching credential upon graduation.

The balance of the student's course work will be in cognate fields at the upper division level. This will tend towards greater sophistication in the sciences, in keeping with modern thinking, and it will also enable the candidate to teach sufficient courses to enlarge his opportunities for employment.

The Master's degree will be awarded upon the completion of the aforementioned course work, and it is contingent upon the student's passing a searching terminal comprehensive examination.

No thesis will be required, nor is one deemed desirable, since the intent is to train the educator rather than the researcher. Time being a factor, it is intended that this program be a "practical" one in the best connotation of the word.

OUTLINE OF THE PROGRAM

I. The geology instructor in the junior college can, at present, hope to teach no more than four one-semester subjects in his major field. The courses most likely to be offered are (1) Physical Geology, (2) Historical Geology, (3) Mineralogy, and (4) Paleontology. The courses in geological education at Montana State University are proposed with this fact in mind. They are as follows:

Geological Education I. Methods of teaching physical and historical geology. Emphasis will be on practice in methods of lecture and discussion, in the use of projection techniques, in handling laboratory and quiz sections, and in leading field trips (for which the student will prepare model guidebooks). 3 quarter credits. Prerequisites: Physical and Historical Geology, and graduate standing or consent of the instructor.

Geological Education II. Methods of teaching elementary crystallography and determinative mineralogy. 3 quarter credits. Prerequisites: Physical and Historical Geology, Mineralogy, and graduate standing or consent of the instructor.

Geological Education III. Methods of teaching general paleontology. 3 quarter credits. Prerequisites: Physical and Historical Geology, Paleontology or Systematic Zoology, and graduate standing or consent of the instructor.

II. The courses in general education will be arranged by the education department for each candidate individually (except for the basic education courses which all candidates will take), so as to enable the candidate to teach in the state of his choice.

III. The related courses in cognate fields—physics, chemistry, mathematics, astronomy, meteorology, botany, zoology, etc.—at the upper division level will allow the candidate the widest possible freedom of choice consistent with a satisfactory program and with his individual inclinations and interests.

IV. The terminal examination will be a stringent searching written examination of three to six hours' duration. It will be in three sections:

1. A general examination to test the range of the candidate's geological knowledge. (An oral exploratory examination is, at present, required of each graduate student in the geology department during his first quarter of residence, and this provision will also apply to the geological education major.)

2. A reading comprehension examination, based upon selections from the literature, to test the candidate's ability to evaluate conflicting points of view.

3. An essay on a subject of general geological interest, to test the candidate's ability to use language with clarity and effectiveness.

TYPE OF STUDENT DESIRED

To whom may this program most appeal? Certainly there are many bright, imaginative students, neither suited for the routine of industry nor gifted as research workers, who may find in the profession of teaching their natural *métier*.

To these students, in particular, the program will be geared. It is intended that the program be sufficiently stringent to discourage the student who may think by this means to earn an easier Master's degree.

Many experienced geologists have expressed the desire to return to academic life. Those who cannot devote several of their most productive years to completing the normal doctoral program may find in this shorter program a means by which to realize their ambition.

There are many women also who by aptitude or interest are well suited to be geologists, but who are lost to the profession either by reason of marriage or lack of opportunity. They may find in this program a worthwhile outlet for their scientific inclinations.

As contemplated, this program will not prevent the ambitious student from working for a more advanced degree in the field of science education; or, possibly at some future time, in the more specialized field of geological education.

It must be emphasized that at present the program is still very much in the planning stage. The writer will welcome any criticism, comment, or suggestion which the interested reader may have to offer.

ACKNOWLEDGMENTS

The writer is deeply indebted to Fred S. Honkala, chairman of the geology department, for his encouragement and help in sponsoring this program. He also thanks his colleagues, Robert W. Fields, John Hower, Jr., Robert M. Weidman, John P. Wehrenberg, and Mrs. Dorothy Miller, for their suggestions and advice.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 8, No. 1, Spring 1960, pp. 9-10.

GROUND-WATER REPORTS FOR OUTSIDE READING IN THE BEGINNING GEOLOGY COURSE

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Middlebury College

ABSTRACT. Each student in the beginning geology course was assigned a ground-water report to read and summarize. Mimeographed instructions, including an outline of items to note, were supplemented by conferences. Students appreciated the practical application of geology and did not find the reports too technical.

Ground-water reports, such as the Water-Supply Papers and Circulars of the U.S. Geological Survey, and similar publications by state geological surveys, are suitable for outside reading by students in the beginning geology course. These reports have three desirable features: 1) the geology is presented in a clear and summary fashion; 2) the reports represent a practical application of geology; and 3) the topic is timely because ground-water geology and ground-water law are becoming increasingly important in our society.

In previous years at Middlebury College, the students had been assigned the topic of "home-town geology". Although there are obvious benefits to such a topic, there are disadvantages. Few students at the beginning level can cope with technical geologic reports. Even if fairly recent geologic reports on a particular area are available, those reports may not be in the college's library or in the municipal library of the area. Also, it is almost impossible for the teacher to check on the accuracy of statements in the student's paper.

Therefore, in 1958-59 each of the 85 students in the beginning geology course was assigned a ground-water report. In preparation, I spent about four hours scanning the Water-Supply Papers concerned with particular areas, noting the number of text pages, the treatment of geology, the treatment of ground water, and special conditions such as salt-water encroachment and waterlogging. By going back to 1938, I had a list of about 85 reports. Those shorter than 15 pages of text, and longer than about 100 pages, were removed from the list, and some U.S. Geological Survey Circulars and state geological survey reports were added. The reports were assigned according to each student's ability; the longer and more technical reports were given to the better students, and the shorter and simpler ones were given to the marginal students. Only about 5 students were assigned reports on areas near their home town.

The students were also given a set of mimeographed instructions, including an outline of topics to look for each in each report:

Introduction: location and size of area; general altitude; average annual precipitation; purpose of study

Geology:

stratigraphy—to be summarized by a chart and columnar section

structure—to be illustrated by tracing a cross-section or by summarizing from text

Ground-Water Conditions:
aquifer—bedrock or surficial deposits
ground-water behavior—recharge (where, what formation, how much); movement (direction, rate, aquifer characteristics); discharge (where, what formation, how much)
special conditions—salt-water encroachment; waterlogging; interference between wells; artesian conditions
wells—yield, depth to water, aquifer; artesian or water-table

Each student checked out his report, keeping it until the assignment was completed. (The librarian was pleased to see "those orange-colored publications that no one reads" put to use.) The assignment was to prepare not more than 4 pages of written material, plus illustrations, summarizing the report.

Considerable time was spent in conference with the students. For most of the reports the mimeographed outline was sufficiently clear and pertinent. In some cases, however, the conference served to focus the student's attention on a particular phase of the report, or on what approach he should use for the report that didn't fit the outline. For several students the conference clarified the significance of the report. Thus, Water-Supply Paper 889f, on the High Plains of Texas, appears to be innocuous enough, but the student and I spent an hour going over the discharge and recharge figures and found that water is being used 30 times faster than it is being recharged. Water-Supply Paper 1379, on the San Luis Valley in Colorado, made sense after the student's attention was drawn to a sentence in the introduction that mentioned Colorado's commitment to release a certain annual volume of water in the Rio Grande to New Mexico.

Each report was turned in to me, along with the student's paper, so that I could check on statements that might be incorrect.

The students had both favorable and unfavorable reactions to the assignment. On the one hand, most students appreciated that their reports were a practical application of geology. They benefited from those reports that described in some detail such features as glacial deposits or lava flows. Most students found that the hydrologic terms, such as coefficient of permeability and coefficient of storage, were explained adequately in the report. Several students enjoyed the assignment. On the other hand, some were not interested in the geology and ground-water conditions of some county in Nebraska or California; they would prefer to write a paper on the geology of their home town. Also, some of them objected to summarizing a report, preferring to do something creative.

Several problems were introduced by giving the assignment in the first semester, before the students had made columnar sections and cross-sections and had learned the geologic timetable; much conference time was devoted to explaining these matters. In general the students' papers were adequate summaries, though difficult to grade. The assignment is far short of the scope of a term paper but nonetheless is well worth doing.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 8, No. 1, Spring 1960, pp. 11-13.

A FUSION METHOD FOR QUICK DETERMINATION OF CERTAIN RARE METALS

T. C. CRAWFORD[1] AND JOHN ELIOT ALLEN[2]

ABSTRACT. Minute amounts of the elements chromium, cobalt, columbium, manganese, tellurium, titanium, tungsten, uranium, and vanadium can be quickly and easily detected with a minimum of equipment by means of simple fusion with ammonium hypophosphite.

While teaching at the New Mexico Institute of Mining and Technology, the junior author became acquainted with a technique worked out by the senior author, then with the chemistry department, for quick and simple determination of the presence of certain rather rare elements: chromium, cobalt, columbium (niobium), manganese, tellurium, titanium, tungsten, uranium and vanadium. After using this method in mineralogy laboratories for six years, and finding that it gave excellent results with untrained students, he decided that it deserved further publicity. He wrote the senior author, who gave permission for this publication and indicated that he himself had made thousands of fusions in working out the tests and was sure that they were satisfactory if the directions are carefully followed.

Many metals which were almost unknown a few years ago have come to play an important part in our technical civilization. Ores containing them may go undetected for lack of a simple test. The following tests have been worked out so that anyone without previous experience can make positive identifications with a minimum of expense and equipment, in either field or laboratory.

Equipment: Crucibles, high form, Coors porcelain, size 0
Tongs, crucible
Bunsen burner or (for field use) pocket blow torch

Reagents: 1 lb. ammonium hypophosphite (Amend Drug and Chemical Co.)
Hydrochloric acid
Nitric acid
Hydrogen peroxide
Metallic tin

All the tests are made by first placing about one-half teaspoonful of ammonium hypophosphite in the crucible. A small amount of the ore to be tested is finely pulverized (this is important, and a small mortar can be added to the kit, although the ore may be ground with a hammer on any hard surface). Take a small knife blade and place the amount that will stay on the point of the knife in the crucible with the fusion powder. With the tongs, hold the crucible in the hot blue flame of the bunsen burner or blow torch (directed upwards) until the powder melts and

[1] Los Alamos, New Mexico.
[2] Portland State College, Oregon.

gases given off catch fire and burn. It is sometimes necessary to lift the crucible off the flame for a moment to prevent boiling over. Dense white fumes are given off while the gases are burning; hence if working in the laboratory, use a hood to carry them off. Continue heating until all burning stops and a hot quiet liquid remains in the bottom of the crucible. This is the fused mass. Heating should continue until the bottom of the dish is a dull red. Observe the color and other characteristics of the fused mass, and then allow the crucible to cool before making further tests.

Fused mass colorless:

Clear: Manganese may be present. Add nitric acid to cooled fused mass, until crucible is about 1/5 full. Carefully boil to dryness. If manganese is present, a rose-purple will appear as the last of the acid boils away.

Black specks: After fusing columbium ore, a few black specks are usually noted. Add hydrochloric acid to the fused mass until the crucible is 1/3 full. Heat to boiling. Set dish aside and while still hot add a piece of tin. A blue color will appear around the tin if columbium is present.

Shiny balls of melted metal or black scum: Tellurium present. Forms a black scum if only a small amount is present. A wine-red color will appear around each small ball of metal if the dish is kept at red heat for at least two minutes after they form. Many ores leave black particles on the surface of the liquid. If no deep red color appears after heating for two minutes, it is not tellurium.

Gray scum: Molybdenite is the only ore of molybdenum which gives a gray scum (all others give a red color). After cooling, pour the crucible about 1/5 full of nitric acid, and carefully boil to dryness. Continue heating until the crucible is again red hot. If molybdenum is present, a greenish-blue color will appear in the fusion mixture. Cool again and add 10 to 15 drops of water. The greenish blue will turn to yellow if molybdenum is present.

Fused mass colored:

Red color: All molybdenum ores except molybdenite will give a red color to the fused mass.

Green color: Vanadium, chromium, or uranium present. Add 10 to 15 drops of hydrogen peroxide to the fused mass. A rose-pink color indicates vanadium, which does not turn green until almost cold. If there is no color change when hydrogen peroxide is added, boil off and heat dish red hot. If color changes to a smoky-gray when hot, the ore contains chromium. This will turn green again when cool. If it remains green while hot, the ore contains uranium. In case only a very small amount of vanadium is present, the green color may be doubtful, but the rose-pink color formed by the hydrogen peroxide is a very delicate test.

AMMONIUM HYPOPHOSPHITE FUSION TESTS
for
Elements Mn, Cb, Te, Mo, Va, U, Cr, Co, W, Ti

FUSION		COLORLESS				COLORED						
I	HOT	Clear	Black Specks	Balls of black scum	Gray scum	Red	Green			Blue		
II	Cool color	x	x		x		Green			Pink	Blue	
III	Add reagent	HNO_3	HCl		HNO_3		H_2O_2				H_2O	
IV	Color						Rose Pink	No Color			Violet	No Color
V	Refusion (hot color)	Rose Purple	x	Wine red	Greenish blue			Green	Smokey Gray	Blue		
VI	Cool color				x				Green	Pink		10 (mins)
VII	Add reagent		Tin		H_2O							H_2O_2
VIII	Color		Blue		Yellow							Reddish Orange
Element Present		Mn	Cb	Te	MoS_2	Mo	Va	U	Cr	Co	W	Ti

Equipment:
Mortar & Pestle
Bunsen burner
Crucible or evaporating dish
Tongs

Reagents and Amounts:
Ammonium hypophosphite: 1/2 teaspoon
HCl - 2 or 3 cc HNO_3 - 1 or 2 cc
H_2O - 10-15 drops H_2O_2 - 10 drops

Fusion:
Heat until crucible is dull red, flames and fumes gone

Crawford & Allen
1960

Blue color: Tungsten, titanium, or cobalt present. Add 10 to 15 drops of water to the fused mass and let stand for a few minutes; if violet color appears, tungsten is present. If no color appears after 10 minutes, add 10 drops of hydrogen peroxide. Intense reddish color indicates the presence of titanium. If original fused mass was blue and changed to pink on cooling, the ore contained cobalt. Mass will turn blue again on reheating.

To properly clean the crucibles, soak in water overnight and scrub with scouring powder. Any residue remaining should be taken off with sand or emery paper. A crucible will normally last for only three or four fusions before being eaten through.

The accompanying chart was devised by the junior author to facilitate reading of procedures and results by his students. Copies of the chart may be obtained from the Portland State College Bookstore, Portland 1, Oregon, at the following prices: 1-50 copies, 4 cents each; 51-100 copies, 3 cents each; over 100 copies, 2 cents each.

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 8, No. 1, Spring 1960, pp. 14-17.

GEOLOGICAL EDUCATION IN CHINA PRIOR TO 1948

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ABSTRACT. Modern education in China was patterned essentially after that in the United States. Departments of geology existed in all major national and provincial universities before 1948. The B.S. degree in geology was offered, and graduate work leading to the Master's degree was begun in 1940. A rigid undergraduate program of geology courses quite similar to that of American universities was required, but specialized courses such as geophysics, micropaleontology, and petroleum geology were not offered. One of the most important and significant features of the program of geological education in China was the invitation of eminent professors from foreign countries. Chinese students were sent by the government to the United States and Europe for graduate work.

Modern education in China was patterned essentially after that in the United States, although curricula, standards, and system of credits were both American and European with some adjustment to local situations. Departments of geology existed in all major national and provincial universities. The B.Sc. degree in geology was offered, although graduate work on the Master's level was not given until 1940, by the Geological Research Institute of the National University of Peking. It was during the war years, when geologists were in great demand, that the Institute was founded. The University was moved to Kunming, Yunnan Province, during World War II. Future planning for graduate work on the doctorate level undoubtedly was interrupted by subsequent political developments. The following paragraphs deal with geological education in China prior to 1948.

Students admitted to a university in China were all 6-year "middle school" (high school) graduates. All basic courses in mathematics, physics, chemistry, biology, and "liberal" subjects were acquired in the "middle school." Those planning to major in a science in the university not only strengthened their science courses but were required to take more science on an advanced level in the university. The freshman geology major in a Chinese university could take only two or three courses in geology, the rest being advanced mathematics, chemistry, physics, and English or another foreign language.

Due to the limited number of universities, rigid entrance examinations weeded out many ambitious students, allowing sometimes only one out of ten to be admitted. Admission to a university was a right earned after passing two- to three-day examinations in all major subjects. Those who failed might repeat the examinations the following year, although some were admitted on scholastic probation or to preparatory classes. The heavy schedule for the Chinese university students allowed little free time for extracurricular activities or athletics. Tuition fees were nominal, most students being wholly supported by their parents. During

World War II, however, students were paid and supported by the central government to finish their college education.

A rigid undergraduate program of geology courses quite similar to that of American universities, and with little leeway for electives, was required. A geology major had to take physical geology and mineralogy as a freshman, then historical geology, stratigraphy, paleontology and petrology in his sophomore year, economic mineral deposits, mining geology, structural geology, and advanced general geology or regional geology of China in the junior year, and optical mineralogy, petrography, advanced paleontology, advanced structural geology and graduate thesis in the senior year. Although no summer field geology courses were offered, many required excursions were scheduled. These often involved weekends and long-distance one-week or two-week trips, to localities of paleontologic, stratigraphic, or structural interest, or to economic mineral deposits. The trips were usually directed by professors or by the geologists of the Geological Survey. Courses not offered were geochemistry, geophysics, polished-section work or mineralography, ground-water geology, micropaleontology, seismology, sedimentation, petroleum geology and subsurface geology. Petroleum geology was not demanded until after major oil fields in northwestern China were discovered during World War II.

Most universities had excellent geological libraries, where students were encouraged to do extensive reading and to write term papers. Since English was the first required foreign language (with German or French as second choice), students were well acquainted with both American and British authors. The textbooks by Grabau, the Yale professors, Dana, Winchell, Willis, Nevin, Lindgren, Daly, Bowen, and Pirsson and Knopf were well known, as were those of European authors, such as Harker, Holmes, Tyrrell, Wells, Hatch, Eskola, Niggli, Grubenmann, and Rosenbusch. Most geology departments had excellent collections of rock and mineral specimens, some obtained in the field or as gifts, others purchased from America and Europe. The best-equipped departments were perhaps those in the National University of Peking and the National Tsinghua University, both in northern China; the National University of Nanking in east-central China; and the National Sun Yat-sen University in southern China. Geology clubs, so popular in many American universities, were not organized, but occasional meetings were held to promote interest in geology. Popular geological journals for which students submitted their writings for publication existed. Faculty members also took this means to publish their articles.

One of the most important and significant features of the program of geological education in China was the invitation of eminent professors from foreign countries, sometimes on an exchange basis. Through the years, stimulating lectures were given on the geology and mineral deposits of North America, the geomorphic and tectonic problems of the Appalachians, the Rockies, and the Pacific Northwest, the geotectonics of landmasses such as the Himalayas and the Alps, problems on igneous geology and metamorphism in general and on shield areas in particular, and on type localities of stratigraphic sections in the British Isles and in North America. A. W. Grabau was invited to the National University

of Peking; his voluminous and important contributions to the geology of China are familiar to all. G. B. Cressey taught for many years at the University of Shanghai. Arnold Heim taught at the National Sun Yat-sen University and conducted geological excursions to the remote regions of the west and extreme south of China. Hans Stille also was invited to Sun Yat-sen University, but instead he sent Peter Misch, who taught there for about six years, and then later for several years at the National University of Peking in Kunming during World War II. Misch's many geological excursions to the remote southwest of China enabled him to explore the problems of granitization, regional geology, and Precambrian metamorphism. In return, J. S. Lee lectured on the geology of China in British universities in 1934 and 1935, and K. T. Huang delivered his concepts of geotectonics to many American universities and geological organizations in 1948.

Numerous eminent geologists also have undertaken their own geologic research in China. Their contributions, concepts, and methods of investigation have invariably influenced and aroused the interest of serious Chinese students. Among them are W. A. Obrutschew, F. von Richthofen, B. Willis, E. Blackwelder, von W. Credner, T. de Chardin, A. Heim, J. Deprat, and G. B. Barbour. The author in his high-school days was so impressed by an exhibit of Heim's exquisite photographs of the Swiss Alps and his artistic geologic sections, sketches, and maps of remote west China that he decided to major in geology. These great men, dedicated to the advancement of geological sciences and education, will long be remembered and cherished by Chinese students. One of them stands out—Professor Grabau. He spent long years with the University of Peking and the Geological Survey of China. In memory of this great teacher, his students erected a statue of him on the campus of the University of Peking immediately after World War II. He will be a source of inspiration and symbol of a devoted earth scientist to all engaged in geologic work and education.

Having graduated from a university and worked for a few years, a Chinese student was usually ambitious to undertake graduate work abroad in America or in Europe. His entire graduate program might be financially supported by the geological organization with which he worked. Students also were awarded scholarships by successfully passing a competitive qualifying examination. The provincial governments almost every year sent students abroad to study. The Boxer-Revolt's Indemnity Funds sent many college graduates in different fields to America and Europe and supported their graduate work and special research programs. Many students managed to study in the United States, principally through the encouragement and assistance of the Chinese immigrants in this country.

There were not as many jobs for geologists in China prior to 1948 as in the United States, so that proportionately fewer students majored in geology. Nevertheless there was a considerable demand for geologists. The Geological Survey of China, with headquarters in the nation's capital in Nanking and branch offices in almost every province, employed large staffs. The Geological Research Institute of Academica Sinica, in Nanking, was not only a place to work but to learn,

and hired large numbers of geologists and university graduates. Teaching positions existed at the university level, and, to those returning from graduate work abroad with the Ph.D. degree, associate professorships and full professorships were offered. Private industries and economic bureaus in most provinces sought for specialists. During World War II, geologists were employed especially to explore the remote west for potential war minerals.

In conclusion, the intellectual climate of the Chinese university, its emphasis on the rigorous training of the individual, and its adoption of a system of basic required geology courses, gave it a significantly refreshing and stimulating character. The invitation of foreign professors to the universities not only broadened the student's outlook in the geological sciences, but raised scholastic standards abreast of the centers of higher learning elsewhere in the world.

TWO NEW N.A.G.T. SECTIONS ORGANIZED

At the suggestion of President Robert R. Shrock and Secretary Freeman Foote, a Southwestern Section of the National Association of Geology Teachers was organized on April 4, 1959. The organizational meeting was held at the University of Arizona in Tucson, at the time of the meetings of the Cordilleran Section of the Geological Society of America. Officers were elected (see back cover), and Milford Benham (Phoenix College) was made chairman of the Nominating Committee.

The new section includes Arizona, Colorado, New Mexico, and Utah. Plans are being made for a first annual meeting and field trip, to be held in the spring at a central place such as Durango, Colorado. Of a potential membership of about 100, the Section started with 16 members; a membership drive is under way to increase this number.

A. J. BUDDING
Secretary-Treasurer

A Texas Section of the National Association of Geology Teachers was enthusiastically organized at a meeting held in conjunction with the annual Texas Academy of Science sessions on December 11, 1959, in Austin, Texas. In addition to the election of officers (see back cover), a committee under the chairmanship of H. E. Eveland, Lamar State College of Technology, was appointed to draft a constitution and by-laws for the Section.

It was decided that the new Section would hold its 1960 meeting with the Texas Academy of Science in early December. If satisfactory, this arrangement can be established on a permanent basis. A symposium on some aspect of teaching in geology was tentatively planned for the 1960 meeting. In addition, a campaign was formalized to publicize the new Section within the state and to encourage membership. The organizational meeting was well attended and the keen interest which it generated was indeed gratifying.

ROBERT E. BOYER
Secretary-Treasurer

JOURNAL OF GEOLOGICAL EDUCATION
Vol. 8, No. 1, Spring 1960, pp. 18-29.

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ROBERT L. BATES
Editor

Prefatory note. A look backward, to see where we have been, is often helpful in looking forward to see where we are going. I hope this index will not only be conventionally useful, but will also indicate what has so far been of enough interest to teachers of geology to warrant publication in their *Journal*. A perusal of the Subject Index reveals that the largest number of papers have been on the elementary geology course; geology in relation to other subjects; historical geology; mineralogy; and teaching aims, methods, and devices. In contrast, little attention has been given to economic geology, geomorphology, paleontology, petrology, and structural geology; or to the teaching of advanced courses. In future volumes of the *Journal*, perhaps teachers involved in this second group of subjects will prove to be as articulate in presenting their problems and methods as those of the first group have been up to the present.

Previous editors of the *Journal of Geological Education* are as follows:

Volume 1, 1951-1953: William F. Read, Lawrence College.
Volumes 2-4, 1954-1956: Anastasia Van Burkalow, Hunter College.
Volumes 5 and 6, and Volume 7 No. 1, 1957-Spring 1959: Mildred F. Marple, Ohio State University.

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In general-education courses: Boardman; Cohee; Lucke, 2; Page; Parsons; Seltin; Thompson.
Research in: Staples.
Graduate school, preparation for: Howell, B. F., Jr.; Langenheim, 1.

Historical geology: Beerbower; Dryden; LaFleur, 2; Mitchell; Robertson, 1.
Field trips: Wickwire, 1.
Review chart: Whitcomb, 1.
History of geology, teaching the: Unklesbay.
Hungary, teaching of geology in: Ferenczi.

Industrial minerals, teaching the: Gillson; Ladoo.
Introductory geology, *see* Elementary geology.

Maps, *see* Teaching aids.
Memorials.
Stanard G. Bergquist: Bates.
Ralph Eriksen Digman: Lowe, 1.
F. M. Fryxell: Delo.
Carl Leland Horberg: Lowe, 2.
Rolfe Werner Juhle: Donnay.
Lynne Kelsey: Warthin, 2.
John Lyon Rich: Marple.
William H. Shideler: Martin.
Mineralogy: Faust; Fisher; Heald, 2; Henderson, 1; Hurlbut; Mason, 1, 2; Montgomery, 2; Roy; Spiroff; Thornton.
And crystal chemistry: Henderson, 2.
Automatic testing program in: Swinnerton.
Binocular microscope studies in: Edmund.
Cleavage, as identification aid: Riley.
In Belgium: Charlier.
In engineering curricula: Grawe.
Teaching aids in: Bray; Dunn; Travis; Winder.
Textbook in: Mason, 2.
See also Crystallography.
Models, *see* Teaching aids.
Motion pictures, *see* Teaching aids.

National Association of Geology Teachers: Behre, 2; Longwell; Robertson, 2.
New type of section meeting: Rosalsky, 2.
New Zealand, training geologists in: Goldthwait.
Nonprofessional geology: Biemesderfer; Montgomery, 1; Sharp, 1; Thiel; Whitmore.
Norway, geological education in: Sweet.

Oil company, geologist in: Goldstone.
Open-book examination: Norris.

Paleontology: Bieber; Langenheim, 2; Thomas.
Pennsylvania, geologic instruction in: Chaffee; Moss; Platt, 1; Willard.
Petrology: Edmund; Wilkerson; Woodford, 1.
Popular geology, *see* Nonprofessional geology; Pre-college geology.
Pre-college geology: Chaffee; Digman, 1; Moss; Mrose; Platt, 1, 2; Stone; Webb.
Preparation for graduate school: Howell, B. F., Jr.

Prospecting, an extension course: Peters, 1.

Report writing: Agnew; Hough; Hunt; Whitmore.
Research: Staples.
See also Teaching.

Salt dome, model of: Adams, 1; Nettleton.
Senior seminar: Allen, 1.
Slides, *see* Teaching aids.
Storage space: Digman, 2; Eveland; Read.
Structural geology: Holmes, 1; Kingsley; Ludlum.
Summer Institute: Henderson, 3.

Teaching: Behre, 1, 2; Fryxell; Gutschick; Higgins, 2; Holmes, 2; Jensen, 2; Kaikow; Lucke, 1.
And research: Campbell, I.; Cooper; Murray; Thurston.
Field geology: LaFleur, 1.
Industrial minerals: Gillson; Ladoo.
The history of geology: Unklesbay.
Teaching aids.
Compass and clinometer: Norton.
Conoscope: Bray.
Declination demonstrator: Ryan.
Demonstration of limestone solution: Schalk.
Diagrams: Adams, 2; Dennen, 2.
Display tray: Wickwire, 2.
Films and slides: Taylor; Threet, 1.
Hand specimens, in petrology: Woodford, 1.
Isogyrometer: Travis.
Maps and charts: Dennen, 1; Peters, 2, 3; Rosalsky, 1; Sharp, 2; Whitcomb, 1.
Mnemonic devices: Higgins, 1.
Models: Adams, 1; Dunn; Holmes, 1; Kingsley; Nettleton; Schaffel; Winder.
Periodic table of elements: Heald, 1.
Template for "three-point problem": Threet, 2.
Tilting blackboard: Turner.
Terminology: Howell, J. V.; Weller.
Textbook: Holmes, 2; Mason, 2; Whitcomb, 2.

Ward's Natural Science Bulletin, articles in: Jensen, 2.
Water-conservation course: Warthin, 1.
Writing, *see* Report writing.

REVIEWS

Mineralogy. L. G. Berry and Brian Mason. xi + 612 pp. W. H. Freeman and Company, San Francisco, 1959. $8.75.

MINERALOGY: Concepts, Descriptions, Determinations, by Professor L. G. Berry of Queen's University, Ontario, and Dr. Brian Mason of the American Museum of Natural History, New York, is another in the series of excellent textbooks of the W. H. Freeman Geology Series. Thoroughly up-to-date, this volume digests succinctly all the mineralogical concepts needed in the training of geologists in an undergraduate curriculum. The authors summarize cogently the basis for the requirement of at least one course in mineralogy in an undergraduate major in geology, stating in the preface that " . . . each individual mineral . . . documents the chemical and physical conditions that caused it to form. . . Minerals are the products of geological processes; from these products we can draw conclusions as to the nature of the processes themselves."

The text is divided into three parts. Part I, Concepts, is presented in seven chapters: Introduction, Crystallography, The Chemistry of Minerals, The Physics of Minerals, The Genesis of Minerals, Determinative Mineralogy, The Systematics of Mineralogy. Part II is Descriptions, and Part III, Determinative Tables. The organization of part I will be welcomed in teaching, since each section is sufficiently independent that the user may assign studies in any order without concern for continuity. The authors are to be complimented for their skill in attaining such continuity.

This reviewer finds in each mineralogy text his greatest concern in the crystallography section. Since most students find spatial geometry difficult, and since most students study crystallography before structural geology and descriptive geometry, the instructor is faced with the dilemma of too much detail or too little, and textbook writers are hard-pressed to make selections that receive general approbation. The authors have succeeded in a very lucid presentation in 137 pages of text, offering an adequate introduction to every basic phase of crystallography. Some users will regret the omission of a summary section on the symmetry constants of the 32 classes of geometrical crystallography, since most students are better able to begin their laboratory study of crystals from the "outside in" rather than from the "inside out." Others will regret the order of presentation of the crystal systems, from triclinic to isometric, but each of these is a minor objection. The text figures are clear and well-placed and the line drawings excellent, although the use of heavy lettering seems an unfortunate choice.

The completeness of the coverage permits an economy for students, since one book suffices for all phases of study; most mineralogy courses are expensive for the student even under most careful planning. This reviewer believes the omission of a section on optical mineralogy to be wise.

The new text is very free of typographical errors, shows care in editing, and has excellent format. The profession should be grateful to the authors and the publishers for this contribution to the effective teaching of mineralogy.

ROBERT W. WEBB
University of California, Santa Barbara

Principles of Mineralogy. William H. Dennen. v + 429 pp., illus. Ronald Press, New York, 1959. $7.50.

This book is a new entry to the list of introductory mineralogy textbooks. According to its preface, it emphasizes principles and attempts to bridge the gap between introductory mineralogy and advanced treatments of crystallography, crystal chemistry, petrology and geochemistry.

Symmetry and crystallography receive a condensed (68 pages), rigorous and elegant treatment that breaks sharply with traditional presentations. One seeks in vain for a clear-cut treatment of such familiar concepts as Steno's Law, Hauy's Law, and axial ratios, and finds but scant explanation of Miller indices. The level is intermediate rather than introductory, and its suitability for beginning students is questionable.

For the space allotted in Chapter 2 (25 pages), crystal chemistry is adequately discussed, and it is further treated in Chapter 6. An interesting innovation is the use of block diagrams of the periodic table showing ioniza-

tion potentials, ionic radii, and crustal abundance (Figs. 2-4, 2-9, and 6-1). One wonders at the omission of the trans-uranium elements from the table in the appendix.

Chapter 3 (28 pages) includes up-to-date discussions of isomorphism, exsolution, polymorphism, order-disorder, twinning, and crystal imperfections. Implications that complete isomorphism exists between clinoenstatite and diopside ignore data on both natural and synthetic minerals. Use of the term "compound" in the sense of "solid solution" (pages 102, 337) is not in conformity with custom.

In view of the broad aims set out in the preface, a less elementary treatment of physical characteristics (Chapter 4, 26 pages) might have been expected, such as some correlation of the Mohs scale with the Knoop and other absolute hardness scales. Depiction of the regular octahedron and dodecahedron as typical of cleavage fragments of fluorite and sphalerite is misleading. A commendable insertion is the brief but clear discussion of crystal growth.

Devotees of the time-honored blowpipe techniques will welcome Chapter 5 on chemical testing (24 pages), including fusibility, bead, sublimate, flame, open and closed-tube, and wet chemical tests.

Chapter 6 devotes a scant dozen pages to mineral paragenesis (a term absent from the index), which, in a book entitled "Principles of Mineralogy", can scarcely be considered adequate. The structural relations of minerals fare considerably better in this chapter. This reviewer believes it is high time that the synthetic counterparts of the natural minerals be accorded status as minerals (page 174).

The bulk of the book (almost 200 pages) presents descriptions of some 150 common minerals. This appears to be the least satisfactory portion of the book. Prospective users should be advised that no determinative tables are included. Descriptions are inferior to those of other recent texts. Tridymite and cristobalite are scarcely mentioned. There seems little merit in naming "associated minerals" where these are too unimportant to be themselves described. There is a surprising waste of blank page-space. Typographical errors are found in the formulas for borax, celestite, gypsum, and pyromorphite. The mineral sketches are in most cases of doubtful value. Figs 7-13 and 7-14 should be interchanged to fit the text.

There has been a long-felt need for a more up-to-date treatment of crystallography and mineralogy at the introductory level. This textbook is one of several recent attempts to fill this need. In the opinion of this reviewer it is less successful in achieving this goal than several other recent publications.

WILFRID R. FOSTER
Department of Mineralogy
Ohio State University

The Study of Rocks in Thin Section. W. W. Moorhouse. xvii + 514 pp. Illus. Harper, New York, 1959. $8.

The entire subject of petrography is covered in this book. Included are an elementary treatment of optical crystallography, tables for the identification of minerals, detailed descriptions of the textures, structures, and mineralogy of igneous, sedimentary, and metamorphic rocks, and a brief treatment of the petrography of ores. Each of the 26 chapters concerned with petrographic descriptions includes a discussion of petrogenesis and a sprinkling of economic geology.

The chapter on optical crystallography is the weakest part of the book. Some of the fundamental principles of optics have been scanned over hastily, and a number of the illustrations are labeled inadequately or poorly. The chapter dealing with the diagnostic characteristics, composition, and occurrence of the most important rock-forming minerals is profusely illustrated with orientation diagrams. About one hundred excellent photographs, on eighteen plates, illustrate many important features of rocks in thin section. However, the magnifications have been omitted from these photographs.

The bulk of the book is devoted to petrographic thin-section descriptions and their genetic interpretation. Preceding the rock descriptions is a chapter consisting almost entirely of a series of tables intended as an aid in tracking down unknown minerals.

The chapters on igneous rocks are more complete than those on sedimentary and metamorphic rocks; the treatment of the subject matter is easy to follow, and the descriptions are concise and well presented. One hundred and thirty-three excellent figures illustrate a total of about four hundred rocks in thin section.

The descriptions of the igneous rocks begin with volcanic rocks. Basic volcanics are discussed first, followed by andesites and related rocks, then by rhyolites, and lastly by the mineralogically complex alkaline volcanics. From volcanic rocks the author proceeds to pyroclastics and then to plutonic rocks. The first chapter on plutonic rocks deals with gabbros and norites, the following chapter with alkali gabbros, and the succeeding chapters with "intermediate" and acid plutonic rocks, feldspathoidal rocks, ultrabasic rocks, and lamprophyres. The sequence of treatment in this book may present a problem with elementary students of petrography. The student getting acquainted with the microscope is called upon to identify minerals in a fine-grained rock when his knowledge and experience in crystal optics is barely adequate for identifying coarse-grained minerals. The danger is that the student at this early stage may begin to rely on "eyeballing" instead of on optics. By working from basic to acid igneous rocks, as prescribed in this book, a student gets acquainted with essexites and theralites before he meets a slice of granite in thin section!

For sedimentary rocks the author devotes a chapter to each of the following subjects: conglomerates and breccias, sandstones and arkoses, graywackes, argillaceous rocks, limestones and dolomites, and, in a final chapter, chert, iron formations, glauconitic sediments, saline rocks, and coals. These chapters need further amplification to make them more complete.

The chapters on metamorphism and metamorphic rocks deal with processes of metamorphism; environmental factors; classifications and definitions; dynamic, thermal, and regional metamorphism; and metasomatism. The different types of metamorphic rocks are described with reference to the particular mode of metamorphism which brought them about.

In summary, this book is well written and profusely illustrated. It is a testimonial to a teacher who has done an outstanding job.

GERALD M. FRIEDMAN
Research Department
Pan American Petroleum Corporation

Principles of Geology, 2nd edition. James Gilluly, Aaron C. Waters, and A. O. Woodford. x + 534 pp. W. H. Freeman and Company, San Francisco, 1959. $7.50.

Certain athletes are complimented when called "ballplayers' ballplayers"; certain actors are pleased to be known as "actors' actors". It seems to this reviewer that Gilluly, Waters, and Woodford's *Principles of Geology* might very well be called (and a sincere compliment is intended) "a textbook selector's textbook". Quite obviously the publishers might be more pleased if their book were firmly established as the "textbook buyer's textbook", inasmuch as there are vastly more cash customers among the students than among the free-loading teaching crowd.

Not uncommonly one hears an instructor of physical geology say, "G.W.&W. is the best text, but I find it too difficult for my beginning students." We suspect that he is following a common pattern—he's studying his lesson from G.W.&W., and lecturing brilliantly upon what he's learned therein. G.W.&W. is the "secret weapon" of many! We wonder how many students study beginning physical geology from some other textbook, only to be told by their adviser, "Now that you've decided to major, you had better buy a Gilluly."

Freeman and Company of San Francisco started the revolution in physical-geology textbook publishing with the first edition of G.W.&W. in 1951. The second edition now comes to us after the decent interval of eight years, all dolled up in the increasingly common two-column format which apparently is demanded by the slightly larger page size. The excellent line drawings are not changed in size from the first edition; as a consequence of the larger page, each is now surrounded by pleasant spaciousness.

There is in this second edition a considerable rearrangement of chapters. The chapter entitled "Minerals and Matter" is the first after the introductory one. Consequently students will come to it in "lecture" about the same time they get to the same subject in "lab", and this is convenient. That difficult topic "Isostasy" is located in the middle of the second edition (it was in Chapter 3 in the first edition). We wonder, however, if it is still not misplaced, separated as it is from

earthquakes and mountains by the chapters on the erosion processes. Isn't isotasy a perfect introduction to earthquakes and mountains, or do we oversimplify? An entirely new chapter, entitled "Sedimentary Rocks and the Environments of Deposition," has been added. After the passage of only eight years since the first edition, such a chapter is exceedingly appropriate and serves to remind us all of how much has been accomplished in the field of oceanography and to renew our faith in the Huttonian doctrine that the present is indeed the key to the past.

Whenever this reviewer gets his hands on a new text, he turns to the section on peneplains and pediments. We thank the authors for sticking to the belief that such things exist. Our own faith has been shaken recently by too many conversations with disbelievers. Apropos of this, Davis is tough to read, but shouldn't his *Geographical Essays* have been included under suggested readings on "Sculpture of the Land", if for no other reason than to recognize to a degree his great influence in the field of geomorphology?

Item: Thanks to the index makers for setting the main references in boldface type. *Item:* Is there an answer sheet for the questions at the end of chapters? It would be enlightening to know what the authors intended as the answer to some of them. (Might avoid embarrassment of instructors too.) *Item:* Why didn't some one notice that the halftone on p. 208 was upside down? *Last item:* If you haven't already done so, better carefully consider this text, especially if you wish to add a good bit of rigor (and vigor) to good old Geology I.

RICHARD H. MAHARD
Denison University

Petroleum Geology, 2nd edition. Kenneth K. Landes. xi + 443 pages, 108 figs. John Wiley & Sons, Inc., New York, 1959. $9.50.

The need for an up-to-date text on petroleum geology is amply demonstrated by the fact that only eight years after writing the preface to his first edition the author writes the preface to a second edition in which he rewrote seventy-five percent of the text. This demonstrates that the art of petroleum geology has evolved rapidly and that new ideas and concepts have been constantly formulated in this eight-year period. This condition arises in part from the rapid expansion in the total number of geologists devoting their efforts to the search for oil and gas. Exact figures are not available, but the growth in membership in the A.A.P.G. is at least an indirect measure. This association had 4350 members at the end of World War II in 1945, 7800 in 1951 when the first edition of this book appeared, and approximately 14,700 when the preface was written to the second edition in January, 1959.

This progress is certainly directly related to the increase in the search for oil, which expanded as manpower became available following the demobilization and education of those who postponed their training during the war years. It reflects the efforts of all explorationists, both geologists and geophysicists, to devise methods to search for oil in difficult areas, and to look for stratigraphic more than for structural traps. Truly, the decade 1950-60 will be recognized by historians as a time of rapid and vast expansion in the art of prospecting for petroleum.

This book is designed by the author "for the student of petroleum geology, regardless of whether he is in the classroom or on the job". Not only have the contents been largely rewritten, but Part III of the first edition, "Present and Future Oil Supplies" (176 pages), has been eliminated. Dr. Landes will expand and enlarge this material into a volume to be called "Petroleum Geology of World Oil Fields", now in preparation. This elimination largely accounts for the smaller size, 443 pages, of the second edition, compared with 660 pages in the first.

The drilling and completion of oil wells, which appeared in the chapter "Exploration" in the first edition, has been expanded and given its own Chapter 2 heading. The original material on exploration has been rewritten and greatly expanded in Chapter 3. The author is careful to point out that "no sharp line can be drawn between exploration and exploitation so far as subsurface geology is concerned, for this branch of petroleum geology is exceedingly useful both in the development of oil production and in the discovery of new deposits." The methods of doing subsurface geology are likewise expanded, in Chapter 4, "Subsurface and production geology". The chapter in the first edition called "Exploitation" has been largely distributed between the above two chapters.

The origin and evolution of oil and gas are given extensive treatment in Chapter 5, pages 138-181. The author recognizes that "investigation of petroleum genesis is not purely academic exercise", but has a very practical value in the search for new deposits. Some of the subtitles are: "Sources of hydrogen and carbon", "Possible source organisms", "Time of oil generation", "Burial and evolution of petroleum", and "Probable source beds in oil fields". The author examines and analyzes all definitive previous articles on the subject, then expresses his own views on the validity of the various theories and ideas.

In Chapter 6 reservoir rocks are examined in great detail. Special treatment is given to fractured rocks, which are of growing importance in modern prospecting. Fractures provide the mechanism for oil and gas reservoirs in such large modern fields as Spraberry in West Texas, and were recognized in the prolific Asmari limestone of the older Iranian oil fields. Chapter 7 deals with reservoir fluids. The role of water and gas as the energy mechanism in oil production is thoroughly covered. In Chapter 8 the subject of reservoir seals is, in the words of the author, "given the dignity of a separate chapter" since "containment [of oil and gas] is only possible if the walls of the container are effectively sealed". The subject is treated under such subheads as: "Qualifications for seals", "Types of seals", and "Postaccumulation seals". Thus in the three chapters on reservoirs a thorough and informative picture is given of the way in which oil and gas occur in the earth's crust.

The organization and arrangement of subjects in this book may appear to some to be backward, or at least to put many things ahead of the more important. The author anticipates such an opinion and justifies his arrangement in these words: "Practice . . . is presented before theory . . . so that the beginner will learn the language of the specialist and observe the sources of evidence and methods of study used in developing the theoretical concepts". Thus it is that such subjects as the origin, evolution, and migration of oil and gas are taken up after such subjects as drilling and producing wells and subsurface geology. To this reviewer this arrangement would seem to suit the geologist in practice better than the teacher or student.

Although this edition is not divided into parts, as was the first edition, there seems to be a logical tripartite division, with Part I, consisting of Chapters 1, 2, 3, and 4, having to do with the profession, drilling wells, exploration and subsurface geology, or the practical side. Part II would include Chapters 5, 6, 7, 8, and 9, and deal with origin, migration and reservoir characteristics. Part III would consist of Chapters 10, 11, 12, 13, and 14, which give definitions and descriptions of the types of traps in which oil and gas have been found.

Falling outside the general scope of these parts is the final Chapter 15, "Regional aspects of accumulation". Here the author has done a fine job of calling attention to the "broad geology" which differentiates the oil-bearing districts of the world from the much larger part of the earth's crust having no oil or gas. He successfully combines here the better ideas of L. G. Weeks, W. E. Pratt, K. F. Dallmus, H. de Cizancourt, W. W. Mallory, and others. This chapter would seem to fit better in the first part of the book as it is now arranged.

In addition to a large number of footnote references, the author has, as in the first edition, included a very useful appendix on "The literature of petroleum geology", conveniently arranged under such subtitles as "Bibliographies", "Symposiums", "Special volumes", "Production statistics", "Contemporary texts and reference works", and "Scientific and technical journals".

The book is well illustrated with carefully chosen diagrams, maps and charts, and a few photographs. Especially noteworthy are the ones illustrating and explaining the many types of oil and gas traps.

Professor Landes acknowledges constructive criticism from a long list of persons prominent in petroleum geology, either in industry or in teaching or research. This edition therefore has had the scrutiny of men who have distinguished themselves in the theory or practice of petroleum geology. It is in every way a readable, useful treatise on the art of petroleum geology and is well designed for use as a textbook, but will be equally welcome to the working geologist.

A. RODGER DENISON
Tulsa, Oklahoma

TRANSACTIONS OF THE NATIONAL ASSOCIATION OF GEOLOGY TEACHERS

MINUTES OF THE EXECUTIVE COMMITTEE MEETING, HELD IN COLUMBUS, OHIO ON DECEMBER 4, 1959.

Present Shrock, Foote, Judson, Mahard, Stewart, and Threet.

The meeting was called to order at 8:20 P. M. The minutes of the last meeting were approved as printed in Vol. 7, No. 1 of the *Journal of Geological Education.*

The report of the *Policy Committee* was then considered and the following actions taken. Judson moved that if an applicant for any grant wished the support of N.A.G.T., he should present a draft of his proposal to the *Executive Committee.* The motion was seconded by Stewart and passed unanimously.

Stewart moved that N.A.G.T. formally request the Council of the Geological Society of America that N.A.G.T. be made one of the affiliated societies of G.S.A. and that N.A.G.T. request permission to hold its Annual Meeting with the G.S.A. at Denver in 1960. Mahard seconded the motion, which was passed unanimously.

Foote moved that the *Executive Committee* approve the recommendation of the *Policy Committee* that the Editor turn over to A.G.I. for publication in *GeoTimes* as much material as possible that is of general interest to the geological profession. Judson seconded the motion which was unanimously passed.

Threet moved that N.A.G.T. set up for the exchange of geological teaching material a central clearing house, to be conducted by Robert C. Ramsdell at Williams College, and that a notice to this effect be placed in *GeoTimes* by the Secretary. Stewart seconded the motion. It was passed unanimously. Mahard moved that a sum of money, not to exceed $50.00, be appropriated for office expenses for the central exchange. Judson seconded the motion which was passed unanimously.

Mahard moved that the report of the *Policy Committee* be approved and that the appreciation of the *Executive Committee* for an excellent report be forwarded to its chairman.

Foote moved that the interim appointment of Robert L. Bates as Editor be approved and that the appointment be extended for a three-year period, and also that the *Executive Committee* send to Mrs. Mildred F. Marple its appreciation of her outstanding performance as Editor. Judson seconded the motion which was unanimously passed.

Foote moved that any member whose dues are in arrears for the previous membership year shall be dropped from the rolls of the Association. The dues year shall end on August 31. Mahard seconded the motion which was unanimously passed. Foote moved that delinquent members may reinstate themselves by paying the current membership year's dues without paying arrears, but that no such member is to receive back issues of the *Journal of Geological Education* unless arrears are paid. Mahard seconded the motion which was passed unanimously.

Judson moved that when a new member joins the Association in the middle or toward the end of the dues year, it shall be the responsibility of the Section Secretary-Treasurer to ascertain whether the dues are to apply to the current or next dues year. Foote seconded the motion. It was passed unanimously.

The subject of Honorary Memberships next came up for discussion and was referred to the *Membership Committee.*

Judson moved and Mahard seconded a motion to appoint Carey Croneis for one year and J. Robert Berg for two years as N.A.G.T. representatives to A.G.I. The motion was passed.

The possibility of making the President and the Past-President the regular A.G.I. Representatives was discussed. It was pointed out that this would help to give continuity in the conduct of affairs of both the Association and the A.G.I. The proposal was referred to the *Policy Committee.*

Stewart moved that Richard Mahard be appointed the N.A.G.T. representative to the A.A.A.S. for two years. Threet seconded the

proposal which was passed unanimously, Mahard abstaining.

Judson moved that York Mandra of San Francisco State College be appointed the N.A.G.T. official delegate to the XXI International Geological Congress to be held in Copenhagen in August 1960. This motion was passed unanimously.

The request of Ronald K. DeFord and Robert E. Boyer that they be authorized to organize a section whose geographic limits should coincide with those of the state of Texas was next considered. Judson moved that a Texas Section be authorized. The motion was seconded by Stewart and passed unanimously.

Foote moved that the *Membership Committee* appointed in the Spring of 1959 be reappointed. Judson seconded the motion which was passed unanimously.

There being no further business to come before the meeting, it was adjourned at 11:45 P.M.

MINUTES OF THE BUSINESS SESSION, NINTH ANNUAL MEETING, DECEMBER 5, 1959.

The meeting, held in Orton Hall, Ohio State University, Columbus, was called to order by President Shrock at 9:10 A.M. The minutes of the last meeting were approved as printed in Vol. 7, No. 1 of the *Journal of Geological Education*. The reports of the Secretary, Treasurer, and Editor, which appear elsewhere in this issue, were read and approved.

President Shrock reported to the members on the actions of the *Executive Committee* at its meeting the previous evening. The Secretary read for C. D. Holmes a summary of the discussions at the Symposium on Geological Terminology held in Pittsburgh on November 4, 1959. Grant T. Wickwire distributed preliminary lists of commonly used geological terms prepared by the N.A.G.T.'s *ad hoc* Committee on Geological Terminology, whose members are Milton T. Heald, Grant T. Wickwire, and Chauncey D. Holmes, chairman.

The Secretary reported the results of the balloting for the 1960 slate of officers. 268 ballots were returned. For President, Carey Croneis received 263 votes; three individuals received one vote each, and two blank ballots were cast. For Vice-President, Charles D. Campbell received 264 votes; three single votes were cast, and one blank ballot returned. For Secretary, Freeman Foote received 266 votes, with a single vote opposed and one blank. For Treasurer, Sheldon Judson received 266 votes, again with a single opposed and one blank.

The President then proceeded to call for nominations from the floor for the hold-over member of the *Neil Miner Award Committee*. Erling Dorf and A. O. Woodford were nominated, and in the ensuing balloting Dorf received 29 votes and Woodford 8. Nominations were then called for two new members of the committee. George H. Crowl and Dorothy J. Gore were nominated. There being no further nominations, these two members were declared elected.

Milton T. Heald said that he was disturbed that students from large universities might have an unfair advantage on Graduate Record Examinations if these institutions had compiled lists of questions in past years. He urged that the Graduate Record Examination Board publish each year's questions after the examinations are corrected and also make a statement of what it considered its requirements.

President Shrock then called for comments on N.S.F.-supported summer institutes. J. B. Patton reported on the Summer Institute which will be conducted during the summer of 1960 by the University of Indiana at its field station in western Montana.

There being no further business, the session adjourned at 9:50 A.M.

REPORT OF THE SECRETARY, 1959

I am pleased to report that the paid-up membership of the Association now stands at 519, the highest in its history. This is an increase of an even 50 members since the 1958 annual meeting.

Other good news is that a Southwestern Section was formed at Tuscon in April, and a Texas Section at Austin in December. I hope to be able to report at the next annual meeting that a North-Central Section has been founded, and that every part of the country is represented by a section.

Otherwise the year has been fairly uneventful. All the officers and chairmen of committees have cooperated with me fully so that all deadlines have been met. For this I am very appreciative.

The problem of communication between outgoing and incoming officers and committees still remains. Professor Shrock has interested himself particularly in this phase of the Association's activities, and has set up a system to help incoming members of the Neil Miner Award committee. He also will be of great help to the new President. While I make no claim that we are now in a position to make changes of officers without a hitch, I think that this year's change-over will be smoother than in the past and that we can hope for improvement each year in the future.

Respectfully submitted,

FREEMAN FOOTE, *Secretary*

REPORT OF THE PRESIDENT

This year, for the first time, our organization has had the name NATIONAL ASSOCIATION OF GEOLOGY TEACHERS as a result of last year's vote of the membership to add the word National to our earlier name. (See Presidential Report of Chilton E. Prouty in this *Journal*, Vol. 7, No. 1, p. 28, Spring 1959.)

Also for the first time this year the Nominating Committee presented a single slate of officers, a change from previous years when a double slate was offered. This change, voted by the membership, seems to have been acceptable and brought out a good vote from our members.

Two national meetings were held during the year. The Association held an afternoon symposium on "Geological Terminology" in the Pittsburgh Room of the Penn-Sheraton Hotel in Pittsburgh on November 4, 1959, concurrently with other programs of the Geological Society of America meeting. It was well attended, and there was vigorous discussion of the papers. All participants agreed that our Association should continue to concern itself with the whole problem of geological terminology and more specifically with revision of the *Glossary of Geology and Related Sciences* (A.G.I. Publication, 1957).

The annual meeting of our Association was held at Columbus, Ohio, on Saturday, December 5, 1959, with the Department of Geology of the Ohio State University as host. A three-hour meeting of the Executive Committee was held at the Deshler-Hilton Hotel on the preceding Friday night, and the actions of this meeting were reported during the Annual Business Meeting on Saturday.

Inasmuch as the Executive Committee has the major responsibility for conducting the affairs of our Association, every effort should be made to arrange adequate space, facilities and time for the Committee at the annual meeting to insure maximum efficiency.

The Neil Miner Award was presented to J Harlen Bretz at the Saturday evening banquet. (Professor Paul R. Shaffer of the University of Illinois accepted the certificate for Professor Bretz in his absence, after Professor Charles H. Behre had spoken about Professor Bretz as a great teacher.) The presidential address, "We the Teachers of Geology", completed the evening's activities. Your President would record an enthusiastic vote of thanks to all of the members of the O.S.U. Department of Geology for their wonderful hospitality and for the efficient way they handled the arrangements for our meeting.

Professor Samuel P. Ellison, your President, and Professor J. Robert Berg represented the Association on the Board of Directors of the American Geological Institute, and the latter two attended the meeting of the Board at the Pittsburgh meeting of the Geological Society of America on Thursday evening, November 4. Future financial support and possible administrative changes were the chief subjects of discussion. The A.G.I. will need all the support it can get from the member organizations, and your representatives recommend that our Association continue its full support of the A.G.I. The recently published *Directory of Geoscience Departments in the Colleges and Universities of the United States and Canada* (AGI Report 11, 1960 edition) is of much value to us as geology teachers and is an excellent example of the important work A.G.I. is doing for geology.

Your President met with the Education Committee of the A.G.I. during the Pittsburgh meetings of the G.S.A. and heard a most favorable report on the Summer Institute for Geology Teachers held at Duluth last summer. This highly successful institute was directed

by staff members of the University of Minnesota, and was sponsored by the National Science Foundation. Members of Professor Chalmer Roy's Education Committee would like to see the N.A.G.T. more actively support and participate in such institutes. A random sampling of members' opinions at the Pittsburgh and Columbus meetings indicates that many of our members strongly favor support and participation in such institutes. Accordingly, our Policy and Executive committees might well discuss this matter at the next annual meeting.

The recently issued Directory of Geoscience Departments mentioned in a preceding paragraph lists almost 1400 teachers of geology, with the rank of instructor and professor, and there are probably as many more graduate students with teaching assignments of some sort. From such a teaching force, probably between 2500 and 3000, we should be able to add several hundred more to our present membership, which is now somewhat more than 500. Individual members can greatly aid the Committee on Membership in bringing about this highly desirable increase.

Our Association should lend strong support and encouragement to teachers and administrators who are trying to improve the quality of teaching of the earth sciences in the grades and in the high schools, and who are trying to develop better teachers for such instruction. Such support is one of our purposes, and we should try to lend it whenever and wherever appropriate.

Your President's term of office has been made pleasant and easy by excellent cooperation from all the officers of the Association. To these he would extend his sincere appreciation.

Respectfully submitted,

ROBERT R. SHROCK, *President*

CITATION OF J HARLEN BRETZ FOR THE NEIL MINER AWARD, 1959

J Harlen Bretz, Professor Emeritus of Geology at the University of Chicago, was born in Ionia County, Michigan, September 2, 1887. After a rural early schooling, he earned a Bachelor's degree at Albion College in 1905. Shortly thereafter he married Fanny Challis, his charming and life-long companion. His two children, Rhoda (Mrs. J. K. Riley) and Rudolf (himself an author of a book on geology), are well known to the many graduate students toward whom Bretz stood "in loco fraterni." Bretz's early teaching career—at high schools in the states of Michigan and Washington—made him familiar with educational problems not frequently within the experience of college teachers. Later he studied for a doctorate at Chicago under the famous team of T. C. Chamberlin and R. D. Salisbury, earning the Ph.D. in geology in 1913.

There followed two years as Assistant Professor at the University of Washington, Seattle, where he was initiated into the local geologic problems. In 1915 he joined the staff at the University of Chicago. There his early contemporaries were J. Stuart Weller, W. W. Atwood, and S. W. Williston, and later Albert Johannsen, Edson S. Bastin, Paul MacClintock, D. J. Fisher, Carey G. Croneis, Francis Pettijohn, W. C. Krumbein, and J. Marvin Weller. It was an intellectually highly stimulating group, though his earlier associates, who by virtue of their seniority set the pace, were perhaps somewhat cool and austere in the eyes of the average graduate student. Into this medium Bretz brought not only his keen scientific acumen and an enthusiasm for the physiographic phases of geology, but a warmth and zest invaluable to the students. It was natural that his crisp and trenchant manner should be compared with that of the strongly dominant Salisbury, but the differences were greater than the resemblances to the careful observer. Salisbury's judgments were final, where those of Bretz were skeptically inquiring and adaptive; Salisbury taught and Bretz sought. Bretz was never too much of a gentleman to be a scholar, but also never too much of a scholar to be a gentleman. Above all, his passion for field documentation, his penetrating analyses, and his ability to set aside his own earlier findings as new data appeared—perhaps through his most outspoken critics—happily influenced (enormously, according to their own accounts) such varied commentators as an outstanding petroleum geologist, a highly theoretical geophysicist, and one of our leading college teachers. Brusque and a bit Cyrano-like in his bearing, he concealed from most the soft heart, which spoke in innumerable acts of kindness to faculty and

students alike. This description is couched in the past tense solely because it is a reminiscence from the speaker's own student days. Bretz's qualities are the *permanent* mark of the man!

From the early Assistant Professorship to Associate and Full Professorships are phrases too terse to describe the role played by Bretz. Besides developing geomorphology as a changing and growing science on the graduate level, he became the departmental mainstay for much undergraduate teaching and particularly on that fundamental element in student training, the field trip—at Baraboo, Wisconsin, and in the Columbia River. Partly as a result of friendly and very important support from the state geological surveys of Oregon, Washington, Illinois, and Missouri, he contributed as a teacher and scientist in a basic manner to the glacial and post-glacial history of the Northwestern States and of the region around Chicago, as well as to a better understanding of cave processes. His chapter on the physiography of the United States in Krenkel's "Geologie der Erde" and his book "The Earth Sciences" (Wiley, 1940) are among his major works; these studies greatly affected his teaching by furnishing concrete illustrations, and in a subtler but very real sense his need for pointed expression as teacher sharpened his scientific observations and gave to his writings a remarkable crispness of style. He has even concerned himself in an amusing manner with dowsing, which, in a widely publicized controversy with a noted author, he summarily and delightedly characterized as "poppycock."

J Harlen Bretz is a great scientist and man; as a teacher he has been outstanding at influencing the best development of young intellects. In presenting to him the Neil Miner Award, the Association honors itself!

CHARLES H. BEHRE, JR.

SUMMARY REPORT OF THE TREASURER

Cash balance on hand, Jan. 16, 1959		$1,186.46	
Income, 1959 fiscal year:			
Dues payments from Sections	$1,455.50		
Donation, East-Central Section	75.00		
Sales of the *Journal*	378.75		
Total income		$1,909.25	
Total cash received			$3,095.71
Expenditures, 1959 fiscal year:			
Journal of Geological Education	$1,212.91		
Officers' expenses	139.64		
Contribution to AGI (10 percent of 1958 dues)	107.90		
Miscellaneous expenses	37.80		
Total expenditures			$1,498.25
Cash balance on hand, Dec. 31, 1959			$1,597.46
Horberg Fund Savings Bonds			325.50
Total cash and bonds on hand, Dec. 31, 1959			$1,922.96

Respectfully submitted,

Sheldon Judson, *Treasurer*

JOHN REED MOSELEY, 1900-1959. Professor John R. Moseley of the Geology Department, Wayne State University, died of a heart attack on April 1, 1959, at New Grace Hospital, Detroit.

Born in Union County, Ohio, Dr. Moseley completed his undergraduate studies at Denison University in 1924 and received his Master's and Ph.D. degrees at Harvard University. Before coming to the College of the City of Detroit (predecessor of Wayne State University) in 1932, he taught at Harvard and the State University of Iowa.

During the last summers of his life, Dr. Moseley was active in a research project with the Pennsylvania Topographic and Geologic Survey on the structure and stratigraphy of the Ordovician Martinsburg shale. Among his contributions to this study were several papers relating to the contact between the Martinsburg and the Tuscarora quartzite (Silurian), and the occurrence of limestone members and basic igneous dikes in the shale. He was joint author of "The Geology of the Lebanon Quadrangle," published last fall in the *Geologic Atlas of Pennsylvania.*

Dr. Moseley was a Fellow of the Geological Society of America. He was a member of the American Association of Petroleum Geologists; the Michigan Academy of Science, Arts, and Letters; the Pennsylvania Academy of Science; the Michigan Mineralogical Society; the National Association of Geology Teachers; and the Michigan Basin Geological Society, which he served as chairman of the Publications Committee (1957-59) and as member of the Field Trip and Guidebook Committee (1954). He was likewise active in committee work for the Pennsylvania Academy of Science.

Dr. Moseley is survived by a daughter, Martha Jean. Burial was in Cambridge, Massachusetts.—WILLARD H. PARSONS.

PREPARATION OF MANUSCRIPTS

It will be most appreciated if authors of papers to be submitted to the *Journal of Geological Education* will follow these simple recommendations.

(1) Make your paper as concise as possible. As the *Journal* appears only twice a year, space is at a premium.

(2) Double-space *everything*—abstracts, text, tables, quotations, lists of references.

(3) Follow the format of papers published in recent issues of the *Journal.*

(4) *Type* simple tables, such as lists; they will be set in print. *Draft and letter* complicated tables, involving many ruled spaces, special symbols, etc.; they will be reproduced photographically.

(5) Do not include line drawings unless absolutely necessary.

(6) Because of expense of reproduction, and the necessity of using coated paper, photographs are acceptable only under the most unusual circumstances.

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THE NATIONAL ASSOCIATION OF GEOLOGY TEACHERS was founded in the Middle West in 1938. In 1951 it became a national association, under which there are at present nine organized regional sections (see inside of this cover). An annual meeting of the national association is normally held in the fall, and most sectional meetings are held in the spring.

The purpose of the Association, as stated in its Constitution, is "to foster improvement in the teaching of the earth sciences at all levels of formal and informal instruction, to emphasize the cultural significance of the earth sciences, and to disseminate knowledge in this field to the general public."

Anyone concerned with geological education, formal or informal and at any age level, is invited to apply for membership. *Inquiries should be addressed to the national secretary,* FREEMAN FOOTE, Williams College, Williamstown, Massachusetts.